

miles in width at 4.20 p. m.; a man and a horse were killed by lightning. At Ada, Minn., a heavy thunder and hail storm, with light rain, moved southeast in a path about a mile in width at 3 p. m. A heavy thunder and rain storm occurred at Kansas City, Mo., in the early morning, and at Independence, Mo., 3 houses were struck by lightning. At Kearney, Nebr., a rainstorm, with thunder and lightning, moved northeast at 1 a. m.; a man was killed by lightning, and buildings were damaged to the extent of about \$4,000. In the evening a severe hailstorm occurred at Camp Poplar River, Mont.

**16th.**—A heavy thunder, wind, and rain storm visited Knox county, Ind., in the evening; buildings were struck and stock killed by lightning, and damage was done to corn and fruit. Severe storms were reported in Illinois, Missouri, and Iowa. At Galveston, Tex., 2 buildings were struck by lightning. At Denver, Colo., a man was killed, 3 others injured, and minor damage caused during a thunderstorm in the evening.

**17th.**—During a heavy rain and thunder storm at Nashville, Tenn., in the afternoon the temperature fell 10° in 4 minutes and 20° in 1 hour. Destructive thunder, wind, and rain storms occurred in Illinois and western Kentucky. A destructive storm was reported in Jackson county, Mich., in the evening. Damage was caused by a hailstorm in Otter Tail county, Minn. Heavy thunderstorms occurred over west Missouri and east Kansas. A heavy storm was reported in the mountains east of San Bernardino, Cal.; in the valley above Redlands, Cal., the storm was reported as having been very severe, and was attended by thunder and lightning. In Death Valley, Cal., a heavy rainstorm occurred in the morning, and a thunder and rain storm in the evening.

**18th.**—Great damage was done in Fayette and Hancock counties, Ill., by a severe wind and thunder storm. At Sioux City, Iowa, a man was killed by lightning, and lightning struck at points in Missouri and Iowa.

**19th.**—A heavy thunder and rain storm occurred at Indianapolis, Ind., in the evening; parts of the city were flooded; a boy was reported drowned, and 3 men were stunned by lightning. A thunderstorm, with heavy rain, occurred at Central City, Ky. Severe storms were reported in Michigan. At Moorhead, Minn., 2 men were killed by lightning. Great destruction by hail was reported near Sanborn, N. Dak. At Chattanooga, Tenn., lightning killed a man, and interrupted traffic on the electric railway.

**20th.**—An unusually severe thunder and rain storm occurred at Tampa, Fla., in the afternoon. Severe thunder, wind, and rain storms occurred in Indiana and Illinois. Severe thunder and hail storms were reported in central and eastern Minnesota. Damage was caused by lightning in South Dakota. Exceptionally heavy rainfall was reported in Montgomery county, Tenn., in the morning.

**21st.**—Severe thunderstorms occurred at Raleigh, N. C., and Augusta, Ga., where damage was done to electric wires.

Heavy thunder, hail, and wind storms occurred in west Missouri and east Kansas, destroying crops, damaging buildings, etc. At Kansas City, Mo., a thunderstorm, moving southeast, with heavy rain, high wind, and hail, occurred in the afternoon; the wind reached 48 miles per hour, and the hailstones were about the size of cherries; frail buildings, fences, etc., were blown down, and other minor damage done. At Hansford, Tex., a storm moved southeast in a path 150 to 200 yards in width at 4.30 p. m., its rate of advance being estimated at 75 to 80 miles per hour; no thunder and lightning were observed. During the afternoon a thunderstorm was seen gathering in the west; it divided, a part going north and the other south. The storm cloud was a dingy gray color and did not touch the ground. Small buildings were overturned and larger ones moved; hail fell heavily; damage to buildings estimated at \$700. A severe storm also visited Farwell, Tex., 7 miles north of Hansford.

**22d.**—Heavy rain and high wind occurred at Savannah, Ga., in the evening. An exceptionally heavy rainstorm occurred at Central City, Ky., in the morning, and at Lillington, N. C., at night. A violent thunderstorm moved northeastward over Vevay, Ind., in the morning; streets and cellars were flooded by heavy rain. During a thunderstorm at night at Galveston, Tex., a boat was capsized in the bay and 3 persons were drowned. A severe storm moved southeast over Brookston, Tex., at night.

**23d.**—Very heavy thunder and rain storms occurred in eastern Pennsylvania and New Jersey; a number of buildings were struck by lightning, and damage was caused by flood and high wind.

**24th.**—During a heavy thunderstorm in the afternoon at New Brunswick, N. J., several buildings were struck by lightning. A thunderstorm, with violent wind, damaged grain near Allison, Kans.

**25th.**—Heavy rain commenced at Milledgeville, Ga., causing destructive floods.

**27th.**—Excessively heavy rainfall caused floods in eastern New York. Western Massachusetts and parts of Vermont were visited by destructive storms.

**28th.**—A severe storm swept through the lower part of Newark, N. J., in the afternoon, in a path about 50 yards in width, unroofing buildings, blowing down trees, etc. The storm cloud had the appearance of a large, whirling, black ball. A heavy rainstorm in the afternoon at Anderson, S. C., damaged crops.

**29th.**—Thunder and hail storms were reported in east and northeast Iowa and northern Missouri.

**30th.**—Exceptionally heavy rain occurred in the morning at Key West, Fla., 0.60 inch being recorded in 10 minutes. A severe northeast gale prevailed along the New Jersey coast, causing some damage to seaside property. During a thunderstorm at Manton, Mich., some damage was caused by hail.

## INLAND NAVIGATION.

### FLOODS.

On the 2d a large area of country along the Arkansas River below Little Rock, Ark., was reported under water, and farms, railway tracks, etc., along the Yalobusha River, Mississippi, were inundated. On the 17th destructive floods occurred along the Platte River in south-central Nebraska. On the 21st heavy damage was caused in Macon county, Mo., by the overflow of the Chariton and Muscle Fork rivers. Heavy rain caused floods in the Schuylkill River about Reading, Pa., on the 23d and 24th. On the 26th great damage was caused to railways and crops by the overflow of streams in Baldwin county, Ga. On the 27th streams in east-central New York overflowed their banks, submerging a considerable extent of country and

washing away bridges and dams. On the 28th the Savannah River reached 26 feet at Augusta, Ga., and washouts were reported on railroads in that region. In North Carolina the Roanoke River was high, and on the 27th fields were submerged about Weldon, N. C.

### LOW WATER.

At Dubuque, Iowa, the stage of water in the Mississippi River the latter part of the month was the lowest ever noted for August, and navigation was rendered difficult.

### STAGE OF WATER IN RIVERS.

In the following table are shown the danger-points at the various river stations; the highest and lowest stages for the month, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, August, 1891 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River.</i>						
Shreveport, La. ....	29.9	16	11.0	1	3.3	7.7
<i>Arkansas River.</i>						
Fort Smith, Ark. ....	22.0	2	15.0	31	2.9	12.1
Little Rock, Ark. ....	23.0	2, 3	19.1	29	4.1	15.0
<i>Missouri River.</i>						
Fort Buford, N. Dak. ....	.....	1	11.7	31	7.4	4.3
Sioux City, Iowa. ....	18.7	1	11.6	31	7.5	4.1
Omaha, Nebr. ....	18.0	1	11.2	31	8.2	3.0
Kansas City, Mo. ....	21.0	3	15.3	31	9.5	5.8
<i>Mississippi River.</i>						
Saint Paul, Minn. ....	14.0	1, 3, 6, 7, 8	2.0	29	1.2	0.8
La Crosse, Wis. ....	13.0	1, 2, 3	2.4	8-31	2.0	0.4
Dubuque, Iowa. ....	16.0	1-4	2.2	26	1.5	0.7
Davenport, Iowa. ....	15.0	1, 2	1.3	25-29, 31	0.5	0.8
Keokuk, Iowa. ....	14.0	16	2.8	30	0.3	2.5
Saint Louis, Mo. ....	30.0	22	19.3	31	10.4	9.4
Cairo, Ill. ....	40.0	24, 25	19.6	18	12.2	7.4
Memphis, Tenn. ....	33.0	27	14.2	20	8.9	5.3
Vicksburg, Miss. ....	41.0	11-14	21.1	25	12.8	8.3
New Orleans, La. ....	13.0	16	6.2	6	4.3	1.9

Heights of rivers—Continued.

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Ohio River.</i>						
Parkersburg, W. Va. ....	38.0	28	12.3	17	4.4	7.9
Cincinnati, Ohio . . . . .	45.0	31	20.1	19	8.1	12.1
Louisville, Ky . . . . .	24.0	31	8.7	18	4.9	3.8
<i>Cumberland River.</i>						
Nashville, Tenn . . . . .	40.0	6	8.4	17	1.7	6.7
<i>Tennessee River.</i>						
Chattanooga, Tenn . . . . .	33.0	4	16.4	19, 20	3.0	13.4
Knoxville, Tenn. ....	29.0	3	6.2	16, 17, 18	1.4	4.8
<i>Monongahela River.</i>						
Pittsburg, Pa . . . . .	29.0	26	9.8	10	2.7	7.1
<i>Savannah River.</i>						
Augusta, Ga . . . . .	32.0	28	26.0	18	6.5	19.5
<i>Willamette River.</i>						
Portland, Oregon. ....	15.0	1-6	6.7	28, 29	3.3	3.4
<i>Susquehanna River.</i>						
Harrisburg, Pa . . . . .	17.0	26	6.7	23	2.0	4.7
<i>Alabama River.</i>						
Montgomery, Ala . . . . .	48.0	4	15.6	31	1.3	14.3

## ATMOSPHERIC ELECTRICITY.

## AURORAS.

Auroral displays were reported in the northern tier of states from New England to Washington, and southward over New Jersey, Pennsylvania, the Ohio and upper Mississippi valleys, Wyoming, and Utah the night of the 28-29th. At Ithaca, N. Y., the display began 8.30 p. m. and continued until after midnight. It began with a segment of diffused light on the northern horizon and increased in extent and brilliancy until 11.30 p. m., when it extended from azimuth 140° to 230° and to altitude 25° to 30°. From 11.30 p. m. to midnight the western half of the display showed considerable activity, with streamers and huge waves of light rushing upwards. The color of the western part of the arch was a delicate purple, and that of the eastern part a pale green. At Buffalo, N. Y., the aurora was observed as a diffused, wavy light extending about 40° along the northern horizon at 8.55 p. m. It increased in brilliancy until 10.45 p. m., and ended 11.54 p. m. At Detroit, Mich., an aurora of a pale yellow color, with numerous streamers, was observed in the north at 10.30 p. m. It extended over about 90° of azimuth and to altitude about 50°. The display was less brilliant at midnight, and disappeared during the night. At Alpena, Mich., an aurora, consisting of an arch of white light extending from the western to the northern horizon and to altitude about 25°, and a dark segment of altitude about 10°, was observed at 9.40 p. m., and continued until 11.45 p. m. White beams of light about 5° in width shot upward from the arch, and darker beams, having a motion from west to east and thence rapidly back to west, rose from the dark segment. At Sault de Ste. Marie, Mich., three brilliant arches of bluish gray light extending from northwest to northeast were observed at 8.15 p. m. The upper arch extended to altitude about 80°, and numerous streamers shot upwards from the lower arch. At 9.10 p. m. the entire western horizon was covered by what appeared to be a swaying, fiery-red curtain. The display disappeared at 11.50 p. m.

At Marquette, Mich., a well-defined aurora, consisting of a bright white light having the form of a folded curtain resting on a bank of cirro-stratus clouds and extending from azimuth about 135° to 225° and to altitude 45°, was observed from 10 to 11.45 p. m. The display had a west to east motion, first appearing in the northwest, disappearing for a few moments, then reappearing in the northeast. At Grand Haven, Mich., an aurora consisting of a bank of light clouds, extending from northwest to north-northeast, with streamers of a pale yellow color, was observed at 11 p. m. At Rapid City, S. Dak., an aurora appeared as a diffused light at 9.30 p. m. It developed into an arch extending from azimuth about 125° to 224° and to alti-

tude about 40°, over a hazy segment, with streamers to altitude about 45°. The display continued until midnight, and was very brilliant at 11.15 p. m. At Bismarck, N. Dak., an aurora, consisting of a pale diffused light and extending from azimuth 170° to 230° and to altitude 15°, began at 8.30 p. m., and ended during the night. The display was very brilliant about 11 p. m., and bright streamers with a movement from west to east were observed. At Grafton, N. Dak., an aurora, consisting of an arch of brilliant light about 15° in height with streamers along its entire length, appeared in the evening. Above the arch a faint flash of light extended upward to 35°. At 10.30 p. m. three-fourths of the heavens were overspread with swiftly changing sheets of light flashing upward to the zenith. At 1 a. m., 29th, a band of light 30° in width extended from the east to the zenith and thence in an irregular line to the northwest. At Custer Station, Mont., a brilliant aurora, consisting of short pale columns which changed into two arches with columns of light shooting upwards, and "merry dancers," appeared at 8.30 p. m. A third arch, which lasted about 30 minutes, was formed above the second one. The lower arches faded away at 11.30 p. m.

Auroras were reported as follows: 2d, Eastport, Me. 3d, Eastport, Me.; Sault de Ste. Marie and Rockland, Mich.; Mount Washington, N. H.; Medford, Wis. 4th, Sault de Ste. Marie, Mich. 9th, Eastport, Me.; Sault de Ste. Marie, Mich. 10th, Glendive, Mont. 12th, Sault de Ste. Marie, Mich.; Peshtigo, Wis. 13th, East Machias, Me.; Sault de Ste. Marie, Mich. 19th, Groveton, N. H. 21st, Choteau, Mont. 22d, Ottawa, Ill.; Choteau, Mont.; Salem Corners, Pa. 26th, Salem Corners, Pa. 27th, Barren Creek Springs, Md.; Glendive, Mont.; Salem Corners, Pa. 28th, Hartford, Conn.; Era and Payette, Idaho; Riley, Ill.; Alta, Iowa; Concord, Williamstown, and Royalston, Mass.; Lansing, Detroit, Alpena, Grand Haven, Marquette, and Sault de Ste. Marie, Mich.; Custer Station and Glendive, Mont.; Nashua, N. H.; Beverly, N. J.; Buffalo, Ithaca, Oswego, Rochester, Constableville, and Turin, N. Y.; Bismarck, Grand Forks, Grafton, and Napoleon, N. Dak.; Garrettsville and Wauseon, Ohio; Salem Corners, Grampian Hills, and Dyberry, Pa.; Castlewood, Gary, Spearfish, Wolsey, and Rapid City, S. Dak.; Fort Du Chesne, Utah; East Sound, Wash.; Harvey, Wis.; and Sundance, Wyo. 29th, Bancroft, Fayette, Fontanelle, Alta, Maquoketa, Osage, and Stilson, Iowa; Thornville, Mich.; Fort Assiniboine and Custer Station, Mont.; North Loup, Nebr.; Grand Rapids, Bismarck, and Fort Buford, N. Dak.; Providence, R. I.; Howard, Gary, Parkston, and Mitchell, S. Dak.; Prairie Du Chien, Shell Lake, Madison, and Harvey, Wis. 30th, Sandwich, Ill.; Alta and Stilson, Iowa; Fort Buford, N. Dak.; Huron, S. Dak.;